Technical Outreach Service to Communities
Document Summary

[Technical Outreach Services for Communities (TOSC) is a program providing free help to communities affected by hazardous substance contamination. We are staffed by university faculty and technical outreach specialists and are a part of the Western Region Hazardous Substance Research Center at Oregon State University. TOSC activities are supported by a grant from the United States Environmental Protection Agency.]

This summary is intended to assist the reader of the document, **Alternative Water Supply Evaluation Olin/Standard Fusee Site, 425 Tennant Avenue, Morgan Hill California**, prepared by MACTEC Engineering and Consulting and dated April 16, 2004.

The document being summarized is approximately 75 pages in length. In order to facilitate a quicker understanding of the contents of the original document, this summary covers the main points of the original document but not the entire document. However, the parts of the original document not summarized are listed or described. The reader of this summary is encouraged to read the original document for a more detailed discussion of the points covered. The document title will be abbreviated as AWSE in this summary.

Parts of this summary were taken directly from the AWSE as were the figures and charts. These excerpts will be italicized throughout this summary.

The AWSE is summarized or listed section by section. The table of contents, acronyms used and a glossary from the AWSE are attached to this summary as appendices.

Executive Summary

The objective of the AWSE as stated in the Executive Summary:

The objective of this Alternative Water Supply Evaluation Report is to identify and evaluate practicable alternatives to provide drinking water supplies to residents served by wells with perchlorate above the action level. This report will be used as a planning tool in the selection of alternative water supplies when a state or federal MCL has been established for perchlorate.

1.0 Introduction

The introduction describes the general organization of the AWSE and the basis for the evaluation of water supply alternatives.

The general organization of the AWSE is:

1. Classify and organize the contaminated wells into groups based on the level of perchlorate identified in each during well testing, by the type of well, the annual production rate of the well and the proximity of contaminated wells to each other and to uncontaminated water sources.
2. Discuss water supply alternatives that may be used. Alternatives include treatment systems placed on existing wells to remove the perchlorate and those alternatives that supply water to users through another non-contaminated source.
3. Evaluate the feasibility and applicability of each alternative to the contaminated wells either individually or in groups at several contamination levels agreed upon by the RWQCB and Olin. Thus the AWSE evaluates water replacement scenarios in preparation for the setting of an MCL for perchlorate.

2.0 Background

Section 2.0 describes the regional geology and stratigraphy of the Site area, summarizes the history of the Site and perchlorate sampling downgradient of the Site, describes water supply resources in the study area, and summarizes information on the types and production rates of water supply wells in the study area.

Notes on section 2.0:

1. Much of the information on geology and stratigraphy was covered in previous reports submitted by Olin.
2. There is a description of the area water supply resources in the Santa Clara Valley, i.e., the SCVWD and other water suppliers.
3. The AWSE categorizes wells into one of three types:

   Primary well types included in this evaluation are domestic water supply wells, agricultural water supply wells (which may have some potable use), and municipal/industrial water supply wells (with potable use) as identified by the SCVWD. These categories of wells are designated using the acronyms "DO", "AG", and "MI", respectively.

3.0 Evaluation Approach

The AWSE identifies wells according to perchlorate levels detected in the range of 6 ppb to 40 ppb. Contamination levels of 40 ppb, 18 ppb, 10 ppb, 8 ppb and 6 ppb were used in the evaluation. This chart from the AWSE shows the wells identified by perchlorate levels:

Perchlorate Concentration (ppb)[1]	Total Wells	Domestic Wells	Agricultural Wells	Municipal/ Industrial Wells	Well Use Not Designated
=[2] 40	3	2	0	1	0
= 18	5	3	1	1	0
= 10	15	11	3	1	0
= 8	77	60	8	7	2
= 6	236	192	31	10	3

Notes:

[1] Perchlorate was detected at least one time at or equal to the concentration. The total number of wells for each concentration category included the wells in the next-higher category (e.g., the total wells in the 6 ppb category included the wells in the 8 ppb category).

[2] The symbol "=" stands for "greater than or equal to".

Each category includes the wells in the category before it in the order of contamination level. For example, the 5 wells with contamination greater than or equal to 18 ppb include the 3 wells greater than or equal to 40 ppb, the 10 ppb include the 5 at 18 ppb and the 3 at 40 ppb, etc.

From the AWSE:

The numbers of wells with perchlorate in each concentration range affected how water supply alternatives were identified and evaluated. The relatively small numbers of wells in the concentration ranges =40 ppb, =18, and =10 enabled water supply alternatives to be identified and evaluated for each individual well. The substantially increased numbers of wells in the concentration ranges =8, and =6 resulted in the identification and evaluation of alternatives for assemblages of wells.

The AWSE then uses charts and figures to show the location, State of California well numbering grid designation, category (DO, AG, MI) and relative production level of the wells at each of the perchlorate ranges identified in the chart above.

3.2 Water Supply Alternatives

This section is of sufficient interest that much of it is reproduced in this summary. Water supply alternatives as described in the AWSE:

Water supply alternatives included:

- *POU (Point of Use) – Treatment system applied to a specific water tap such as a sink faucet.*
- *POE (Point of Entry) – Treatment system applied to the water entry point to a well user. A POE system treats water so that water from any of the well user's taps has been treated.*

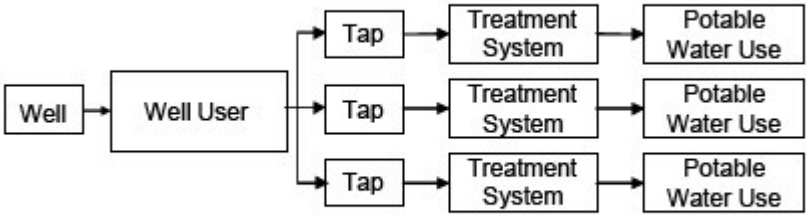
- *Well Head Treatment – Technology system applied to a well at the point water is pumped from the ground. The treated water is then distributed to a single or to multiple users.*
- *Centralized Treatment – Treatment system applied to one or more wells at a location other than the individual well heads. The treated water is then distributed to single or multiple users.*
- *Expansion of an Existing Distribution System – Connection of individual well users to an existing distribution system.*
- *Modification to an Existing Well – Modification of the well that includes extending the depth of the well to incorporate unaffected zones and/or use of well packers to isolate an affected layer from the rest of the well so that the well does not draw water from that zone.*
- *Replacement Water Supply – Distributing water from relatively high production wells with perchlorate levels below the AL to nearby users.*

The AWSE then describes each alternative and the considerations for each. The text and tables on the following pages are taken directly from the AWSE.

POU Treatment Systems

Well users may tap a portion of the water drawn from an agricultural or industrial well for potable use; treatment is needed for that portion of the flow that is used for potable water. For potable water uses that are limited to single taps (such as offices or businesses that may have only one tap for potable water) POU treatment devices may be appropriate. POU devices treat water from an individual tap and are conceptually presented in the following figure.

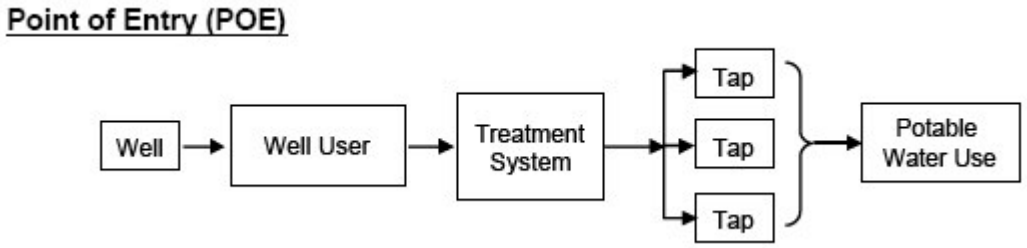
Point of Use (POU)



Considerations for POU Treatment		
Advantages	**Disadvantages**	**Information Requirements**
• Removes perchlorate from water to below 6 ppb	• Requires maintenance for long-term operation	• Number of taps within a building that may require treatment
• Relatively easy installation and maintenance	• High concentrations of perchlorate will require larger systems or more frequent maintenance	• Water usage, perchlorate levels, and peak demand usage data
• Versatile application to any water tap	• Access to buildings needed for installation and maintenance	• Acceptability by well users
• Minimal training for the well user is required for O&M		• Certification by the NSF is pending for Ion Exchange POU systems

POE Treatment Systems

For domestic wells serving a home or a building with several potable water taps, a POE system may be appropriate. POE treatment systems treat water going to multiple taps. The treatment system may be placed outside the home or in other accessible locations and water entering the building is treated before being distributed. Conceptual representations of a POE treatment system is provided in the following figure.

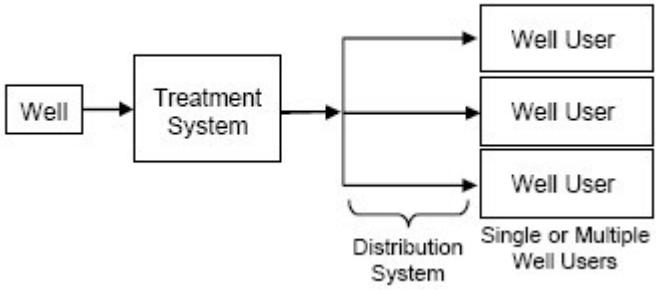


Considerations for POE Treatment		
Advantages	**Disadvantages**	**Information Requirements**
• Removes perchlorate from water to below 6 ppb	• Requires maintenance for long-term operation	• Water usage and peak demand usage data
• Suitable for a wide range of perchlorate concentrations	• High concentrations of perchlorate and/or higher flowrates will require larger systems or more frequent maintenance	• Acceptability by well users for this treatment
• Versatile application to a variety of building types and flow rates (homes, offices, restaurants)	• Continuing O&M required	• Certification by the NSF is pending for Ion Exchange POE systems
• May be installed outside of buildings reducing access requirements		
• Minimal training for the well user is required for O&M		

Well Head Treatment

Agricultural, municipal, and industrial wells are often used at higher annual production rates than domestic wells. Treatment of the drinking water component of the flow at the well head is effective for medium- to higher-production agricultural and municipal/industrial wells. Water treated using this well head treatment can be used as a potable water supply and for other uses. Additionally, treated water could potentially be distributed to nearby users. A conceptual representation of a well head treatment system is provided in the following figure.

Well Head Treatment

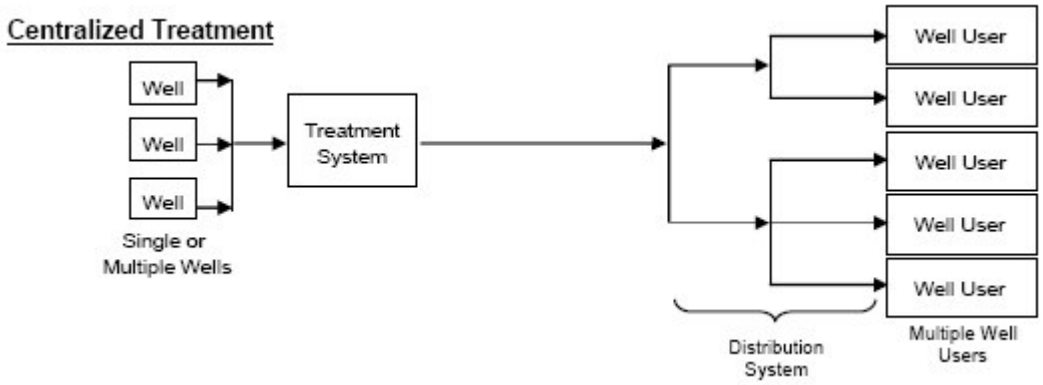


Considerations for Well Head Treatment

Advantages	Disadvantages	Information Requirements
• Removes perchlorate from water to below 6 ppb	• Requires maintenance for long-term operation	• Water usage and peak demand usage data
• Suitable for a wide range of perchlorate concentrations	• High concentrations of perchlorate and/or higher flowrates will require larger systems or more frequent maintenance	• Distribution system design requirements
• Allows unrestricted use of water from the well	• Certification of system by DHS is required	• Acceptability by well users/owners for this treatment system
• Installed outside of buildings reducing access requirements	• Distribution systems may be needed if a well is used as a supply well for multiple users	• Well availability for this use
• DHS has approved well head treatment systems for perchlorate removal		
• Maintenance is generally performed by trained operators		
• Treated Water may be distributed to other users		

Centralized Treatment

Centralized treatment of water would consist of the collection of water from several sources for treatment at a centralized system and distribution of treated water to multiple users. Centralized treatment systems may be similar to a well head treatment program but will generally include several wells pumping to a centralized treatment system. Centralized treatment may involve construction of a collection system for several wells followed by a distribution system to individual users. Centralized treatment systems may be applicable for relatively closely spaced wells. A conceptual representation of a centralized treatment system is presented in the following figure.



Considerations for Centralized Treatment

Advantages

- Centralized treatment systems are capable of treating water to below 6 ppb perchlorate
- Once centralized treatment and water distribution systems are in place, additional water users can be connected to the system as needed by expansion of the distribution system
- Centralized treatment and water distribution systems can readily utilize water sources from outside the area of the evaluation. For instance, if wells used for water supply to the centralized treatment system do not supply adequate quantities of water, then water from additional sources such as other (existing or newly constructed) high production rate wells can be connected to the system to provide additional water.
- An area water systems would provide flexibility for users and unrestricted water use for users connected to the system
- Centralized treatment systems do not require owner maintenance or training

Disadvantages

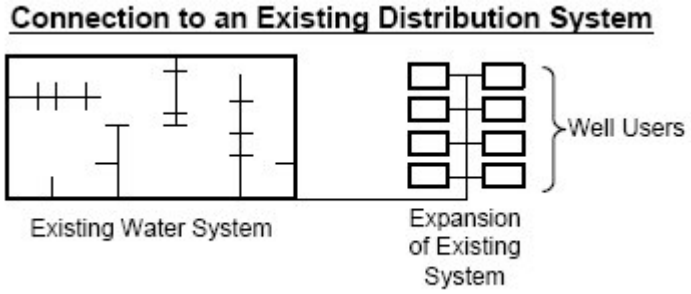
- Installation of new centralized treatment systems would take longer than POE/POU and well head systems to plan, design, permit, and construct (Assuming POE/POU systems obtain NSF approval).
- If a water distribution system currently exists, it may need to be modified to incorporate a new or altered centralized treatment system.
- Rights-of-way must be obtained for new water distribution to and from a centralized treatment system, and a distribution system must be developed if one does not currently exist.
- Property must be obtained for development of centralized treatment systems.
- Capital costs for centralized treatment systems are high and installation, operation, and O&M must be done by qualified personnel.
- Issues related to ownership and to responsibility for long term operation and maintenance of centralized treatment systems must be addressed.
- Certification of system by DHS is required

Information Requirements

- Water usage and peak demand usage data
- Distribution system design requirements
- Collection system design requirements
- Acceptability by well users/owners for this type of treatment system
- Availability of suitable wells

Expansion of Existing Distribution Systems

Several municipal and county water systems exist within or bordering the study area. Other water systems serving small collections of users and small communities also exist. Well users with wells that have had detections of perchlorate above the AL could be connected to these systems. Development of additional infrastructure would be required to connect a user to an existing distribution system. This alternative is conceptually presented in the following figure.



Considerations for Connecting to an Existing Distribution System

Advantages

- Provides potable water to well users with detections of perchlorate above 6 ppb
- Water utility structure is in place
- Monitoring of the system is already conducted for existing system
- No owner maintenance is required
- No training of a well user is required for O&M
- Operation and maintenance of the treatment system is performed by trained operators
- Connection of adjacent well users is relatively easy
- Water treatment system is already permitted and certified

Disadvantages

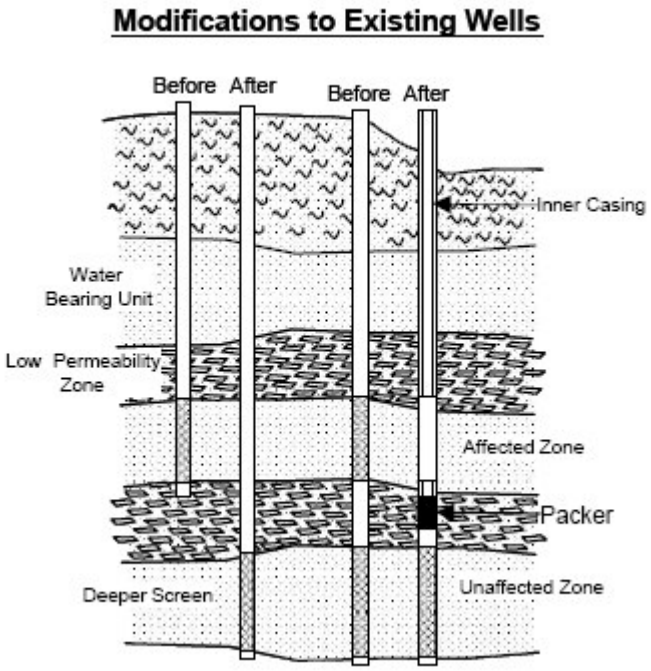
- Availability of existing systems is limited
- Additional utility for well user
- Construction of additional distribution systems will require construction permitting
- Additional system water resources may be needed to supply additional water
- Connection to a distant supply line will be expensive
- Certification of system by DHS is required

Information Requirements

- Water usage and peak demand usage data
- Capacity of existing water supply wells and distribution systems
- Distribution system design details, locations and connection requirements
- Acceptability by well users/owners for connection to an existing system
- Condition of an existing distribution system
- Acceptance of an existing small community system to allow additional connections
- Specific information on the types and numbers of existing small systems

Modifications to Existing Wells

Modification of an existing well with perchlorate detected at or above the AL would involve extending the well depth to tap into clean zones and/or the use of well packers to isolate a perchlorate affected layer from the rest of the well so that the well draws water from clean zones. These alternatives are conceptually presented in the following figure.



Before making modifications to existing wells, information must be obtained on well depth, screen intervals, and well construction. To isolate water bearing units affected by perchlorate from unaffected zones, packers should be placed in sections of blank casing between screen intervals. Wells with continuous screened intervals without intervals of blank casing are not good candidates for modification by placement of packers. A well must have a large enough diameter to allow for placement of a packer and an inner casing in which a pump can be set. Wells with inside diameters smaller than six to eight inches are therefore not good candidates for modification by placement of packers. Information on well construction must be obtained so that packers can be properly selected and installed.

For instance, of wells where perchlorate was detected at concentrations greater than or equal to 10 ppb, some wells extend to total depths of 200 feet with a single screen interval in the lower portion of the well. Deeper wells at these locations may encounter zones that are unaffected by perchlorate. Other wells extend to depths greater than 200 feet and have screen intervals below 200 feet that are isolated from shallower screen intervals by blank casing. If these wells are of sufficient diameter and construction, and deeper zones are unaffected by perchlorate and produces

sufficient water, the deeper screen interval can be isolated using a packer and inner casing.

Testing should be done before existing wells are modified to ensure that deeper water bearing zones are not affected by perchlorate. This can be done by isolating and sampling existing deeper screen intervals in the wells, isolating and sampling deeper screen intervals in nearby wells, or installing monitoring wells to deeper zones and sampling for perchlorate. Deeper unaffected zones must also be tested to confirm that sufficient water production can be obtained from the zones.

Considerations for Modifying an Existing Well

Advantages

- Provides potable water to well users with detections of perchlorate above 6 ppb
- No change in how an owner uses a wells
- Allows for continued use of basin groundwater resources

Disadvantages

- May increase the vertical gradient between water bearing units
- May change the production of the well
- Maintenance of the packers (if used) is required
- Will require access during well testing and modification
- Will require long-term monitoring

Information Requirements

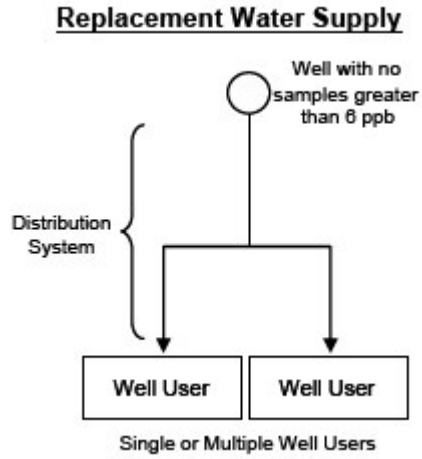
- Water usage and peak demand usage data
- Capacity of existing water supply wells
- Aquifer modeling to show that perchlorate will not be drawn to unaffected zones in a concentration above 6 ppb
- Acceptability by well users/owners to allow modifications

Replacement Water Supply

Groundwater from higher-production wells where perchlorate has not been detected above the AL can be distributed to users of lower-production domestic wells. This may be effective:

- *Where the annual production of a potential replacement supply well is relatively high and sufficient capacity is available;*
- *Perchlorate has not been detected in samples from the potential replacement supply well at or above the AL;*
- *The potential replacement supply well is close enough to the lower production wells to make distribution of treated water feasible; and*
- *The increased pumping needed from the potential replacement supply well is small enough not to cause significant expansion of the well's radius of influence or capture zone.*

A conceptual representation of a replacement water supply well system is provided in the following figure.



Considerations for Replacement Water Supply Wells

Advantages

- Water can be distributed without treatment if perchlorate has not been detected or is below the AL in water currently pumped from the potential replacement supply wells
- Annual production rates of medium and high production replacement supply wells may only need to be increased by a small percentage (generally less than 5 percent), thereby minimizing expansion of the replacement well's radius of influence and capture zone
- If necessary, water storage tanks can be installed to meet peak demands to minimize the degree of increased pumping needed from a replacement supply well by allowing storage tanks to be refilled during low demand times

Considerations for Replacement Water Supply Wells

Disadvantages

- Monitoring programs for wells used as a replacement supply may need to be established to monitor for perchlorate.
- A well with suitable capacity may not be available
- Distribution of water to nearby users of lower-production wells would require development of a water distribution system if one does not already exist
- Right-of-ways may need to be obtained for a water distribution to users
- Construction of distribution systems require permitting
- Issues related to ownership and to responsibility for long-term operation and maintenance of a replacement well must be addressed

Information Requirements

- Water usage and peak demand usage data
- Distribution system design details, locations and connection requirements
- Acceptability by well users/owners for this type of system
- Availability of suitable wells

Comparison of Water Supply Alternatives

Each alternative presented has potential advantages and disadvantages and may be more applicable in a given situation. Generally, POU and POE treatment systems can be applied to any potable water supply application. Well head treatment may be more applicable if a well serves several homes such as an apartment building, subdivision, etc. Also, connection to an existing distribution system (as available) may be feasible for some well users. Well head treatment with distribution systems and/or centralized treatment systems may also be practicable if well users are grouped together and can be served from a single treatment system. Advantages and disadvantages for each alternative are presented in the preceding sections. General applications for these alternatives are compared in the following table.

	Potential Water Supply Alternative							
Application	**POU**	**POE**	**Well Head**	**Well Head w/ Dist.**	**Centralized Treatment**	**Connection to an Existing System**	**Well Mod**	**Replace-ment Water Supplies**
Individual residence		X				X	X	X
Multifamily residences (apartments/ condominiums)		X	X			X	X	
Multi-home Residential Areas (Subdivisions/Mobile Home Parks)		X	X	X	X	X	X	
Well that serves a School or other Institution w/ many potable water taps		X	X			X	X	
Industry w/ Few Potable Water Supply Taps – Single Building (Stores/Offices)	X	X				X	X	X
Industry w/ Many Potable Water Supply Taps – Single Building (Restaurants)		X	X			X	X	
Industry w/ Potable Water Supply Taps – In Multiple Buildings (Factory)	X	X	X			X	X	
Residence served by an Agricultural Well	X	X				X	X	X
Areas w/ mixed use and multiple wells (alternative for an individual well user or for collections of users)	X	X	X	X	X	X	X	

Following the description of the alternatives is a discussion of the types of shared water systems as defined by the SCDEH and DHS. The AWSE states that the 90 shared water systems in the Santa Clara Valley would be candidates for a centralized or well head treatment system, connection to an existing system, or well modifications. Collection, area and multi-area water systems are discussed with water supply alternatives evaluated for each.

The AWSE provides a list of issues that complicate or impede the implementation of the alternatives considered. The list is of potential issues but not necessarily all the issues that may arise:

- *Availability of existing infrastructure such as distribution systems, treatment units, or water treatment facilities. Available infrastructure will allow a more timely replacement of water supply for users.*
- *Reliability of treatment units or facilities. Systems used will require certification/ permitting by DHS.*
- *Acceptance of items such as treatment units or treatment facilities by overseeing regulatory agencies and the NSF.*
- *Need for construction of treatment systems, distribution systems, connections to individual users, and replacement supply wells. Time required for permitting for construction, obtaining necessary easements, right-of-ways, and establishing agreements with owners would be extensive.*
- *Need for and degree of operation and maintenance (O&M) for components of an alternative. Treatment/distribution systems implemented will require O&M and responsibilities for conducting O&M, costs associated with O&M; establishing agreements for O&M will require extensive time.*
- *Certification of treatment systems – technology for public treatments systems requires certification and/or permitting by various state and federal agencies depending upon the scale of the technology selected. For example, the NSF certifies POU technology for various substances in drinking water but has not yet certified a treatment technology for perchlorate.*
- *Long-term O&M responsibility – includes responsibility to conduct O&M, repair of distribution systems, treatment units, etc., replacement of damaged or broken components, monitoring performance, costs associated with O&M, etc.*
- *Ownership of system(s) – includes issues related to liability, O&M, costs of providing water supplies, and public acceptance.*
- *Quality assurance/quality control for system installation and operation – includes verification of system installation, specifications of components, implementation of technology, and certification by regulatory agencies.*
- *Access and rights-of-way for construction – includes procurement of easements, access agreements.*
- *Permitting – involves regulatory acceptance of a alternative and/or technology, implementing permit requirements, monitoring, construction permitting may also be required.*
- *Community relations and acceptance – public will be involved through most steps in the process of implementing water supply options.*

4.0 Perchlorate Treatment Technologies

Despite the title of this section it focuses mostly on ion exchange treatment systems. The following chart is taken from the AWSE:

Considerations for Ion Exchange Technology	
Advantages	**Disadvantages**
• Capable of reducing perchlorate concentrations to below 6 ppb	• Potential for fouling and scaling of the resins reducing performance
• Accepted by DHS	• Long-term monitoring may be required
• Relatively low capital costs	• Requires disposal or regeneration of resins
• May be obtained with a wide range of capacities	

Notes from this section:

1. There is no NSF certification for POU/POE treatment systems for perchlorate, however, it is pending.
2. Perchlorate treatment systems in use in other part of California are described including the systems used by the WSMWW and SMCWD.
3. Other technologies are listed with a short description of each. Most of these were described in a previous report submitted by Olin in March 2003 and summarized by TOSC.
4. Some of the technologies listed are still in the research phase of development.

5.0 Evaluation of Water Supply Alternatives

This section presents evaluations of water supply alternatives for potable water for wells where perchlorate has been detected at or above 6 ppb. The evaluations are based on the available well information provided by the SCVWD, groundwater sampling results, and from information obtained during field sampling activities. Evaluations were made for wells with perchlorate concentrations greater than or equal to a range of values from 6 ppb to 40 ppb. The concentrations selected were greater than or equal to 40 ppb, 18 ppb, 10 ppb, 8 ppb, and 6 ppb.

The AWSE evaluates alternatives for the wells in the 40 ppb, 18 ppb and 10 ppb concentration ranges individually since there are so few wells in those ranges. Wells in the 8 ppb and 6 ppb ranges are evaluated in groups.

For example, there are three well in the greater than or equal to 40 ppb range. This chart from the AWSE summarizes the data on these wells:

Well Information				Water Supply Replacement Alternative				
Well Designation	Abbrev. Desig.	Well Use	Rel. Prod.	POU	POE	Well Head Treatment	Connection to a System	Replacement Supply Well
09S03E34C002	34C002	DO	Low		X		X	X
09S03E34C003	34C003	MI	Low	X	X	X	X	
09S03E34G001	34G001	DO	-		X		X	X

The evaluation then looks at the possible alternatives for each well individually, describing the advantages and disadvantages of each alternative. The alternatives considered are from the list of those alternatives described in detail in section 3.2:

Well 34C002 and Well 34G001

Wells 34C002 and 34G001 are domestic wells. Potential water supply alternatives include:

POE – Since these wells are separated from each other and probably serve single family dwellings, POE treatment for these wells is a practicable alternative. This treatment system can treat water for the whole house and is relatively easy to install and maintain. Impediments related to POE treatment systems may include (among others): NSF has yet to certify a POE system for perchlorate removal, training to residents for O&M may be needed, long-term maintenance of the system is required.

Connection to an Existing Distribution System – Both these wells are relatively close to the city limits for the City of Morgan Hill and may potentially be connected to that system. This solution would require relatively little O&M and no training for the user would be required. Impediments related to connecting to an existing distribution system may include (among others): capacity of the system, construction of additional distribution system, and acceptance by a home owner/resident to participate in a multi-user system.

Replacement Water Supply Wells – There are wells relatively close to this area that have not had perchlorate detected above the AL and have sufficient production rates to distribute water to these well users. Water from a replacement well would not require treatment. Impediments related to using a replacement water supply well may include (among others): construction of a distribution system from the well to a residence, acceptance by a replacement well owner to distribute water; acceptance by a resident to participate in this system.

Well 34C003

Well 34C003 is a low production municipal/industrial well that also serves as potable source of a single family dwelling. Potential water supply alternatives for this well include:

POU – Since this well serves an industry a portion of the flow may be used to provide potable water for workers. Potentially potable water may be provided by one tap making POU practicable. Impediments related to POU treatment systems may include (among others): NSF has yet to certify a POU system for perchlorate removal, training to workers for O&M may be needed, long-term maintenance of the system is required.

POE – If there are multiple potable water taps within a single building, a POE device may be more practicable that a POU. A POE treatment system will provide treated water to each tap that is connected to this system.

Well Head Treatment – If multiple potable water taps are used over a disperse area or in multiple buildings, well head treatment could be used. This system would treat all the water extracted from the well and provide potable water at any tap connected to the distribution system. Impediments related to well head treatment systems may include (among others): permitting requirements, training to workers for O&M may be needed, and long-term maintenance of the system is required.

Connection to an Existing Distribution System – This well is relatively close to the city limits for the City of Morgan Hill and may potentially be connected to that system. This solution would require relatively little O&M and no training for the workers would be required.

***Other Water Supply Alternatives** – Other alternatives presented in Section 3.0 may not be practicable for wells in the greater than or equal to 40 ppb range. For instance, for the domestic wells, multiple POU treatment systems may be required. Well modification may also not be suitable for these wells since they are relatively close to the site and low production rate wells generally may have a continuous screen.*

The AWSE repeats this process for wells at the greater than 18 ppb and 10 ppb levels.

Because of the increased number of wells at the greater than 8 ppb and 6 ppb levels, the alternatives are considered for groups of wells and the evaluation detail decreases since alternatives are not considered for each individual well.

In order to facilitate evaluation of alternatives for the increased number of wells at the 8 ppb and 6 ppb levels, the AWSE designates areas of the Santa Clara Valley to group the wells. This chart shows the area designations:

Area Designation	North Extent	South Extent	East Extent	West Extent
A	Tennant Ave.	San Martin Ave.	Highway 101	Railroad Ave.
B	San Martin Ave.	Masten Ave.	Highway 101	Monterey Ave.
C	Tennant Ave.	North of San Martin Ave.	Foothill Ave.	Highway 101
D	North of San Martin Ave.	Buena Vista Ave.	Foothill Ave.	Highway 101
E	South of Buena Vista Ave.	---	Ferguson Road	Highway 101

The AWSE looks at the wells in each of these areas and evaluates the alternatives in a similar though more general process than was done for the higher level ranges. The alternatives were generally evaluated based on well usage and well density.

6.0 Summary and Conclusions

The summary reiterates the focus of the AWSE: to evaluate alternatives for water replacement in those wells contaminated with perchlorate. Alternatives discussed in section 3.2 include those that treat the water to remove the perchlorate and those that supply perchlorate-free water from another source.

> *Water supply alternatives were developed for various scales of application and included: individual wells, collections of wells, areas with many wells spaced relatively close together, and multi-area systems that included two or more areas with interconnected distribution systems. The alternatives also included various treatment systems: POU systems, POE systems, well head treatment systems, and centralized treatment systems. Alternatives not involving water treatment included: connection to existing distribution systems, well modification, and utilizing replacement water supply wells.*

The summary explains the preliminary nature of the AWSE, particularly for the number of wells in the greater than 8 ppb and 6 ppb ranges. More data and study will be needed and several issues resolved before an alternative is implemented:

> *Development of a detailed assessment for the numbers of wells encountered in the 8 ppb and 6 ppb concentration ranges will involve detailed evaluation of production rates, acceptance of the selected treatment alternative by regulatory agencies and well users, infrastructure needs, water usage rates; agreements with well owners and city and county agencies; and community involvement. These issues are magnified by the number of wells and resolution must be completed prior to implementation of a selected alternative. Therefore, implementation consideration at the scales encountered in the 8 ppb and 6 ppb concentration ranges will be considerably more complex than expected for the 40 ppb, 18 ppb, and 10 ppb concentration ranges.*

Appendix A: Table of Contents

CONTENTS

Appendix B

ACRONYMS

ac-ft/yr - acre-feet per year
AL - Action Level
AG - agricultural well
CFPD - Central Fire Protection District
ClO4- perchlorate ion
DHS- California Department of Health Services
CVP- Central Valley Project
DO -domestic well
DWR -California Department of Water Resources
ft -feet
ft bgs- feet below ground surface
GAC- granular activated carbon
Gpm- gallon per minute
GRA- Georgia Research Alliance
MACTEC- MACTEC Engineering and Consulting
MCL- Maximum Contaminant Limit
MI- municipal/industrial well
MRP- Monitoring and Reporting Program
NSF- National Sanitation Foundation
OEHHA- Office of Environmental Health Hazard Assessment
OES- Office of Emergency Services
O&M- operations and maintenance
Olin- Olin Corporation
PHG- Public Health Goal

POE- point of entry
POU- point of use
ppb- parts per billion
RWQCB- California Central Coast Regional Water Quality Control Board
SCDEH- Santa Clara County Department of Environmental Health
SCRWA- South County Regional Wastewater Authority
SCRWS- South County Recycled Water System
SCVWD -Santa Clara Valley Water District
SMCWD- San Martin County Water District
Standard Fusee- Standard Fusee Corporation
SWP- State Water Project
WSMWW -West San Martin Water Works